Mutual Electric Manufacturing Co.

Knowles System

Brooklyn N.Y.

DIE ERSTEN BRÜDER

VON METZ

VERSCHOLLEN

2021.22.02

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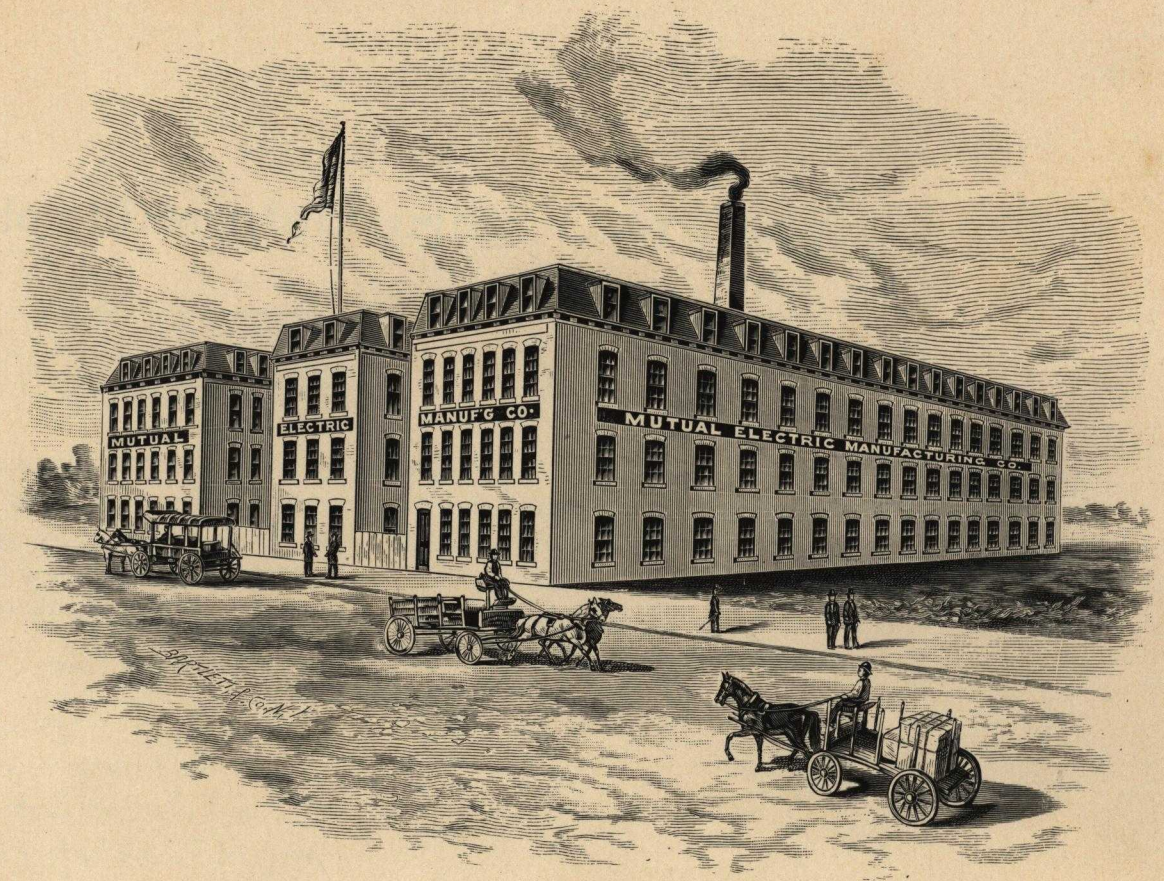

Mutual Electric Manufacturing Company.

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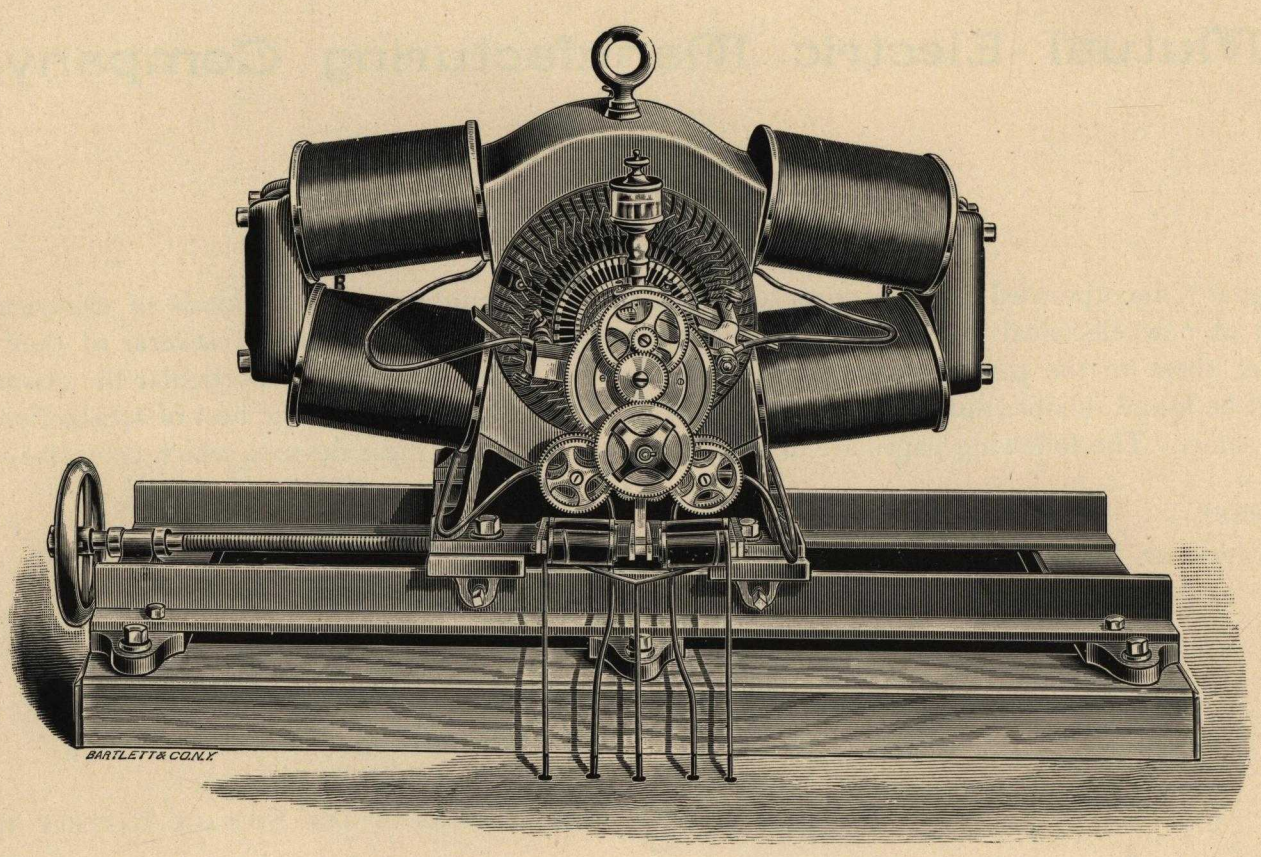
Mutual Electric Manufacturing Company.

INTRODUCTION.

This Company, incorporated for the purpose of the general manufacture of all kinds of electrical apparatus, and the development of new electrical inventions and devices, having practically developed several of their most important devices, now offer them to the public with the assurance that they will fulfill in every particular the claims made for them, and that they will be found reliable, durable, and economical to a degree, and will give the best of satisfaction to all purchasers and users of the same. The following pages are devoted to a description of these devices, which comprise—

A Storage Battery,
A System of Incandescence Lighting,
A Traction System for Street Cars,
A Car Lighting System,
An Arc Light System,
A Combination System,
A Fire Alarm System,
And General Applications of the Storage Battery to various uses.

These devices are the inventions of Mr. E. R. Knowles, the electrical engineer of this Company, and are covered by United States Patents issued and others now pending in the Patent Office, all of which are owned and controlled by this Company, and the public are cautioned against purchasing and using infringements of the same.



DYNAMO (SIDE VIEW).

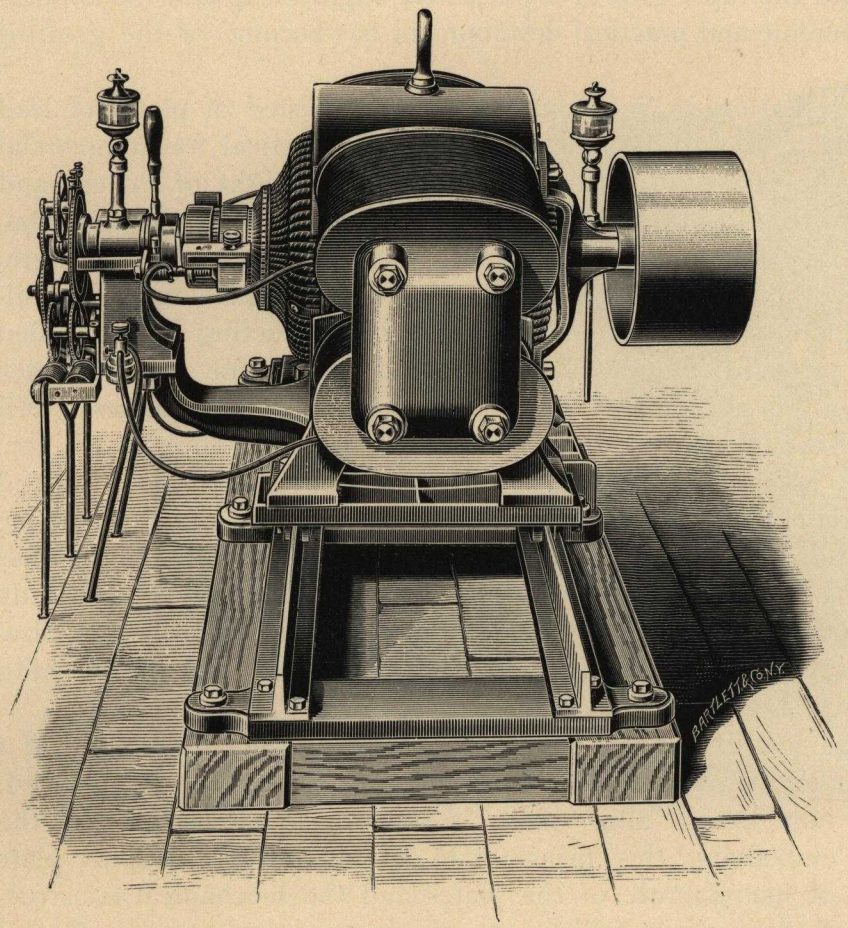
FIG. 1.

THE STORAGE BATTERY.

The storage of electricity, popularly so called, is rapidly becoming a matter of the greatest importance. The subject, one of great interest, has engaged the attention of scientists for a great many years, but its practical development has not, until recently, kept pace with other electrical devices. But now, with the rapid growth of electrical engineering and the application of electricity to so many new uses, the necessity for its economic and practical development has become of the greatest importance.

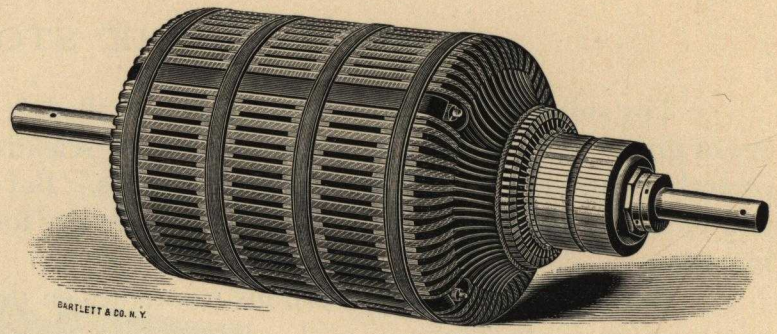
In 1860 Plante made known his researches on the Storage Battery or Secondary Pile. It consisted of plates of lead immersed in dilute sulphuric acid, which, while a success from a scientific standpoint, was not practical for commercial purposes, for various reasons, viz.: the large surfaces required to be exposed to chemical action, great weight of battery and the great length of time it took to prepare the plates so as to receive a charge of any great magnitude. It was a success, however, as it would, under proper handling, give a high and steady electro-motive force and any desired current strength, showing that the principle involved was correct and only needed proper development to bring it to a high state of usefulness. All lead plate batteries are founded on the principle of Plante's invention,—an electrode of conducting material filled or coated with active matter. It is on account of this very principle, founded upon the oxidation of the support plates (which oxidation cannot be prevented), that all batteries made on this plan rapidly deteriorate, and soon become useless. All improvements upon Plante's secondary pile during the last five or six years by various electricians, notably Faure, Brush, etc., have this same defect, and their improvements only delay but do not prevent the inevitable result, the rapid deterioration and disintegration of the battery plates, due to the support material being slowly but surely eaten away and turned into active material. This was and is a serious obstacle to their use, and if it were not possible to overcome this difficulty, some other method of storage would have to be devised or the whole subject given up as impracticable. The first one to practically solve this difficulty was M. Julien, who introduced a battery with electrodes, whose support conductor is practically inoxidizable, and so is not eaten away and disintegrated, only the active material applied to this support being capable of being chemically acted upon. This was a great advance upon all other batteries.

But the discovery of an inoxidizable support plate was not all that was necessary to meet all the requirements of a perfect storage battery. It remained for Mr. E. R. Knowles to discover a means of overcoming the difficulties that existed. This he has accomplished, and has also discovered a new inoxidizable alloy which is superior to all others, and the battery now offered by this Company is an improved form, embodying this principle of an inoxidizable support plate together with other and valuable improvements in the method of manufacture of the plates and the mechanical construction of the battery by means of which all buckling of the plates, scaling, falling out of plugs of active material, and sulphating, is perfectly avoided and the durability and efficiency of the battery very greatly increased. All lead plate



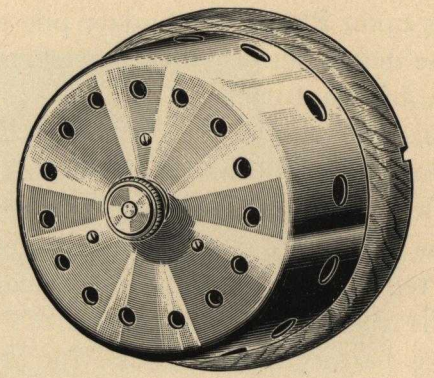
DYNAMO (END VIEW).

FIG. 2.



ARMATURE (FOR 25-LIGHT MACHINE).

FIG. 3.



LAMP REGULATOR.

FIG. 4.

batteries, up to date, are troubled more or less with these difficulties, especially the buckling of the plates and the falling out of the active material. This is largely due to a misconception of the true chemical actions which take place in a battery cell, and faulty and erroneous methods of manufacture, a battery plate with an inoxidizable support plate being no exception, if faultily constructed.

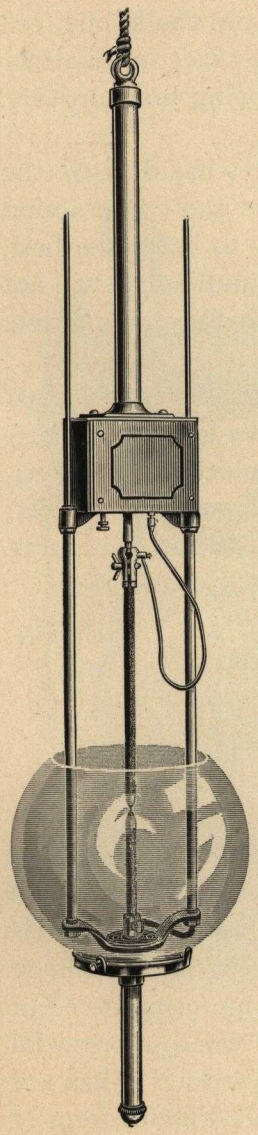
After several years of practical experience in the manufacture of Storage Batteries, Mr. Knowles has devised the present battery cell which we now offer for public use. In it are obviated all the defects of manufacture and construction which he has found in this and other forms of battery, and we now confidently offer our Storage Battery as being the best, most durable, and most efficient battery in the market. Its plates will *never buckle* or twist, under proper handling; it will not sulphate and its active material will not fall out of the plates. It has a minimum of inactive material in its construction, and it has the maximum output of current for any battery of its size in the market.

The standard cell is shown in Fig. 14. This is known as the type E cell and is the size for which there is the most demand, although batteries of any size can be furnished as desired. It is made up of 19 plates (10 negatives and 9 positives). Its general appearance is shown in the cut. Its internal resistance is very low, about 0.015 ohms, and its electrical capacity, varying with the rate of discharge, is from 125 to 200 ampere hours. Its weight is 25 pounds; electro-motive force, 2 volts; maximum current, 30 amperes; floor space occupied, 8 inches by 9 inches; height, 9 inches. The cell is furnished in two forms, one in glass jars for stationary installations and the other in rubber or composition boxes, with covers for motive purposes.

ELECTRIC LIGHTING BY STORAGE BATTERIES.

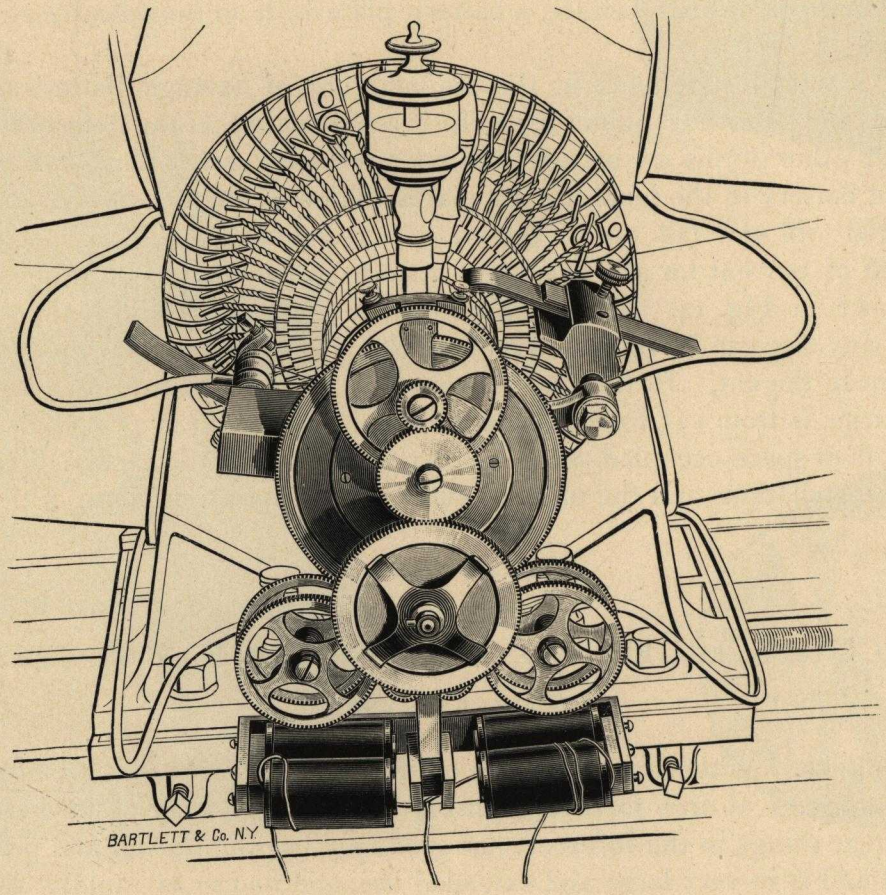
(KNOWLES SYSTEM.)

Since the introduction into the United States in 1879 of the Electric Arc Light by Brush and the Electric Incandescence Light by Sawyer, the progress of this form of lighting has been steadily upward and onward. At first crude and unsatisfactory, yet promising great things in the future, it has gradually been improved and perfected until now the Electric Light is all that can be desired and is in very large and extended use, and its use is rapidly spreading and becoming almost universal in its application. It does not seem as though the Electric Arc Light could be very much more improved, it having permanently taken its place as an illuminant for all out of door lighting and also for all large spaces where a powerful but not perfectly steady light is desired. While the Incandescence Electric Light has also made rapid strides, it has not quite kept pace with the Arc Electric Light, largely due no doubt to its being a much more complicated and difficult form of lighting to perfect and handle.



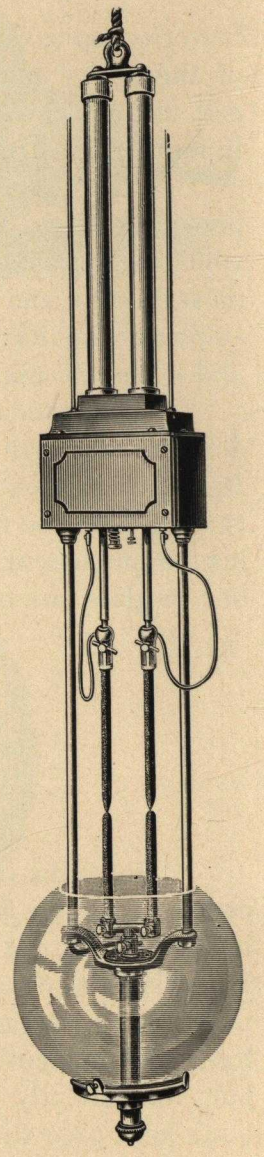
SINGLE ARC LAMP.

FIG. 5.



AUTOMATIC REGULATOR.

FIG. 7.

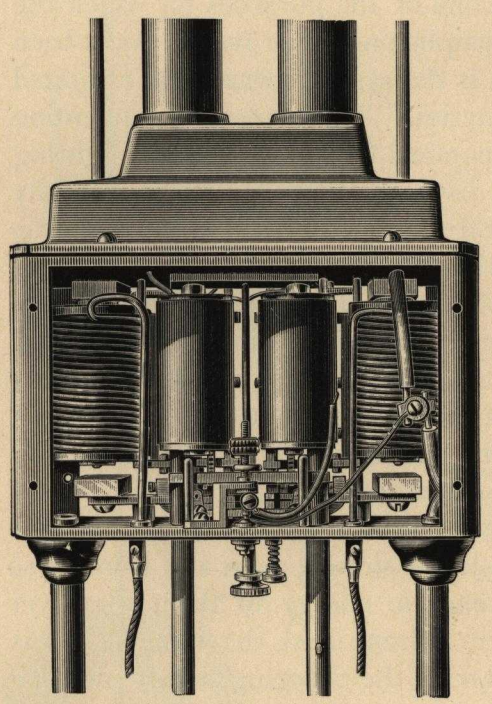


DOUBLE ARC LAMP.

FIG. 6.

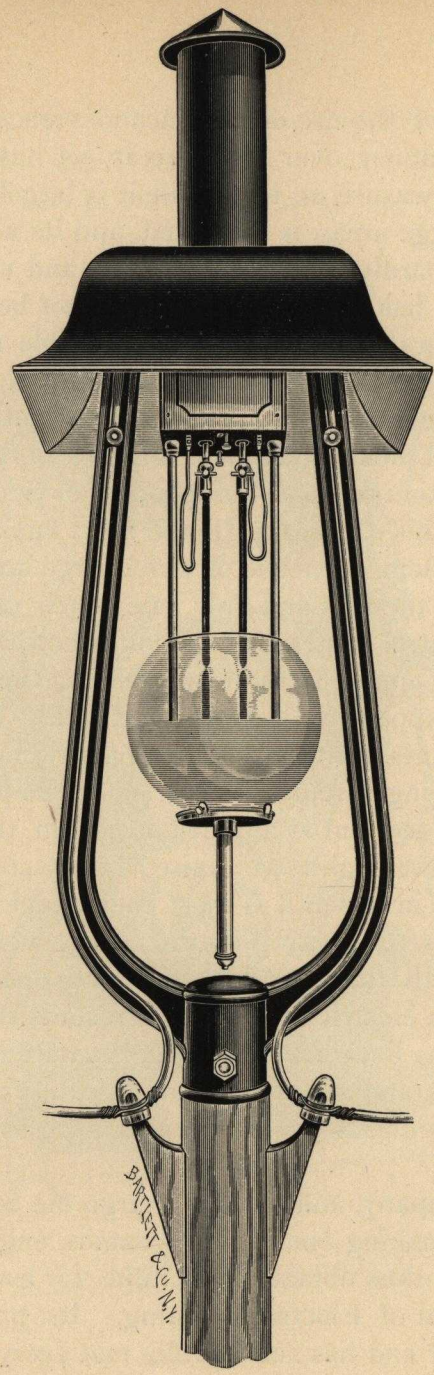
One of the chief difficulties in the way of the use of the Incandescence Electric Light is the difficulty encountered in distributing it in an easy and economical manner over large areas, as has been successfully done with the Arc Electric Light. This has impeded its progress in a measure, so that while it is largely used in isolated plants and in a few large distributing stations, its use, distributed over large areas, is restricted, and its ultimate place, the lighting of dwelling houses, or Domestic Lighting, as it may be called, has hardly been entered upon, and until this difficulty of easy and cheap distribution to any distance from the generating station has been overcome, will not be largely entered upon. Within the last few months improvements looking to the occupation of this large and profitable field of lighting, a field where probably nine-tenths of all the Electric Lighting has yet to be done, have been introduced, and this is one of the purposes for which the Mutual Electric Manufacturing Company has been incorporated. Several methods of accomplishing these results have been suggested, but the one which offers the best and most economical solution of the problem is the system owned and exploited by this Company, which is a system of distribution by means of Storage or Secondary Batteries. This system, the invention of E. R. Knowles, the electrical engineer of this Company, is the most flexible and economical for long distance lighting that has yet been introduced and is the only system by means of which large areas, at long distances apart, can be successfully lighted from one central point or station, and is the first and only one which can successfully compete with gas for domestic use. This system consists generally of a central generating station, where are located the necessary electric generators or sources of electric energy, which may be of any approved form, suitable for the charging of Storage Batteries. Here also are located the boilers and engines and all the apparatus used in controlling and governing the distribution of the electric current. At this point all the distributing circuits center at a common switch-board and the automatic regulators and safety devices are located. From this point the charging circuits are carried to the places where the Storage Batteries are located, which may be at any point where lights are needed and at any distance from the generating station, within a radius of fifty miles. The Storage Batteries are located wherever lights are desired, in any convenient position in the cellar of the buildings, or outside in the yards, or in fact any places in which it is most convenient to put them. At these points are located the necessary switches, indicators, and safety devices, for controlling the charge and discharge of the storage cells, and from these points are carried the wires which connect with the electric lamps and distribute the electric energy to them whenever needed. Each building is also furnished with a electric meter which records the amount of current used, the same as gas is registered. When the charging of the battery has been accomplished, the battery is cut out from the charging circuit and each set then becomes a station in itself, isolated from and independent of all external help. This is a general outline of this system of lighting, subject to such modifications as circumstances may render necessary; and it will be seen that there is no limit to its flexibility and far reaching distribution.

The dynamos manufactured by this Company, and used to charge the Storage Batteries, can be used at night to run a system of Arc lights for the streets, etc., thus making one set of dynamos, engines, etc., successfully operate two distinctly different kinds of Electric Lighting. There is thus obtained full value for every pound of coal burned, giving this system an earning capacity obtained by no other system of Electric Lighting. Its practicability is unquestioned, and this system has now been in operation for more than a year and has successfully met every test to which it has been subjected.



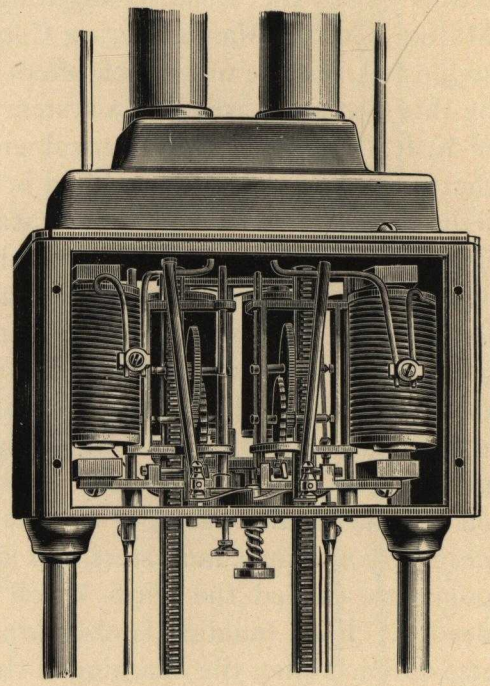
ARC LAMP (INSIDE VIEW, BACK).

FIG. 8.



POLE TOP, HOOD, AND LAMP.

FIG. 10.



ARC LAMP (INSIDE VIEW, FRONT).

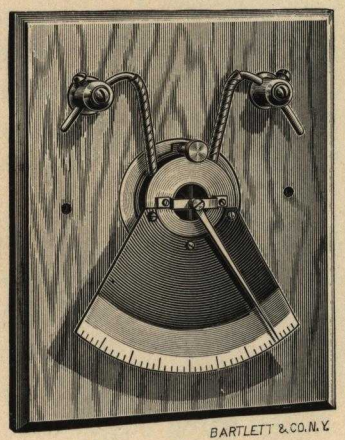
FIG. 9.

ELECTRIC TRACTION.

The subject of Electric Traction is very old; the problem has been worked over and over again for a great many years, and there is very little new which has been added of late years, so far as the mechanical appliances are concerned. But as regards the method of obtaining the current to work the electric machinery a very marked advance was made when the Storage Battery was introduced and applied to Electric Traction. For this purpose the Storage Battery is particularly available, being in a large majority of cases the only practical solution of the problem. It is particularly applicable to street car traction, and is the only way in which electric propulsion can be applied to them in city work.

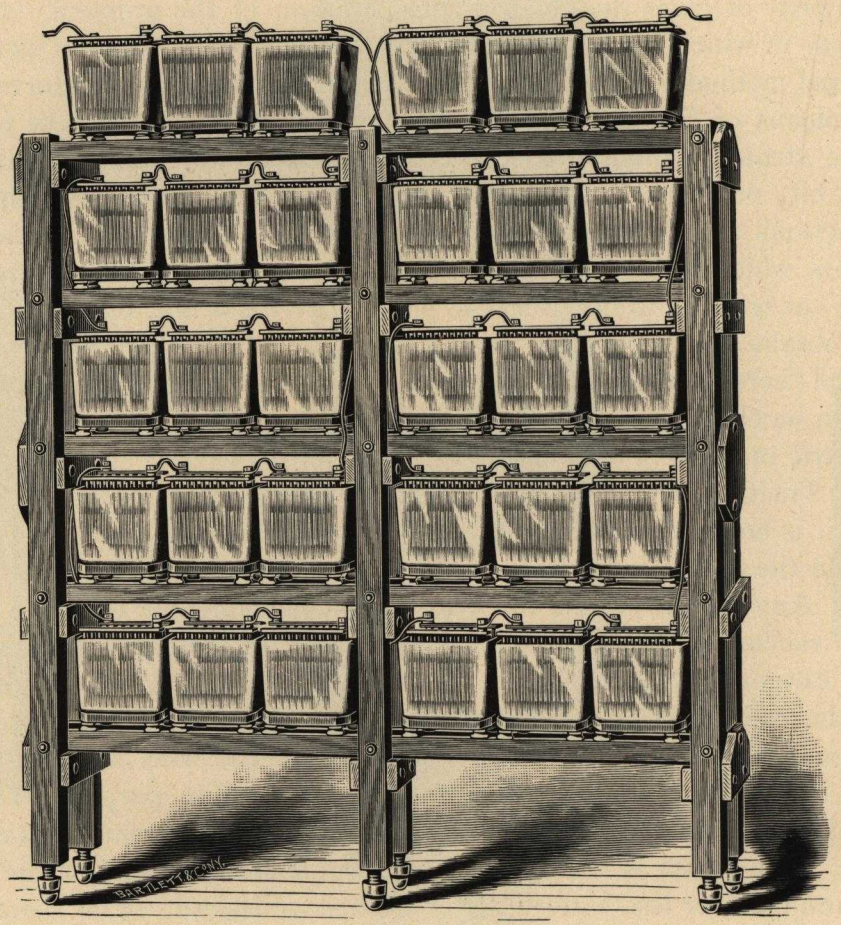
There are three principal methods of electric propulsion; one by overhead conductors, one by underground conductors or a third rail, and one by means of Storage Batteries. The first method is the best for all suburban work and all spaces where overhead wires can be strung without interference. This does not apply within the city limits, as the stringing of such wires is not permitted by city ordinances, which is a sufficient barrier. The second method is only applicable to elevated roads and such like constructions and certain special cases of surface roads, it being next to impossible, up to date, to put down underground conductors which will work successfully. A successful system of street car traction must have the same elements as the present horse car traction to be a success, viz.: Each car a unit by itself, independent of any outside source of help, and this can only be obtained by the use of some form of battery which is portable and can be carried in sufficient quantity in the car itself, and there is no form of battery so feasible as the Storage Battery. In this system the cars are so arranged that the batteries can be charged at any convenient point and when charged can be readily and easily put upon the car for use in driving the electric machinery attached to it.

The system of Electric Traction offered by this Company is very simple, compact, and durable. In carrying it out, the endeavor has been made, and it is believed successfully, to so apply a system of Electric Traction, that the present cars in use need no alterations further than the arranging of receptacles for the batteries and the attaching of the motor and gearing directly to the car and axles. Any system which involves the entire change of the cars, or any very great alterations in the same, will fail to be generally successful, as very few car companies fully equipped with cars will desire to go to the expense of changing them for other cars or making any great alterations in them; and that system, other things being equal, which involves the least changes in the rolling stock and is the easiest applied, will be the most successful in the long run. This has been the aim of this Company, and its system can be applied to any car with scarcely any alterations being necessary. A special form of battery plate is manufactured by this Company for traction purpose. The batteries are carried under the seats, the motor is arranged under and independent of the car and midway between the axles and connected to both of them by the transmission gearing. The motor is under perfect control from either end of the car, so that the car can be started, stopped, and reversed at will and more or less battery power applied as desired. The spent batteries can be quickly removed and charged ones substituted in their place, and the whole system is built for service, durability, and economy. The motor used is of the Gramme type and involves several novel features, one of which is the sectional armature by the use of which in case of accident any coil can be removed and another substituted in a very short time, and another the novel reversing gear. The car is also lighted from the same batteries which run it, and an electric alarm is also operated from the same source. Such a system of traction, properly applied, affords at once a material saving over any other form of propulsion, it being perfectly safe, steady, under control, always ready for use, reliable and economical, and is the coming method of street car traction.



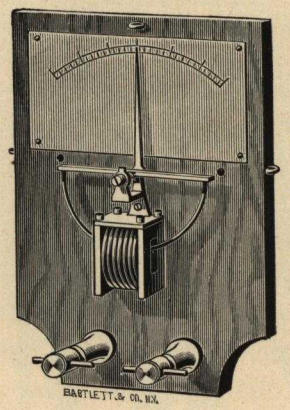
VOLT AND AM-METER.

FIG. 11.



STORAGE BATTERY AND RACK.

FIG. 12.



CURRENT INDICATOR.

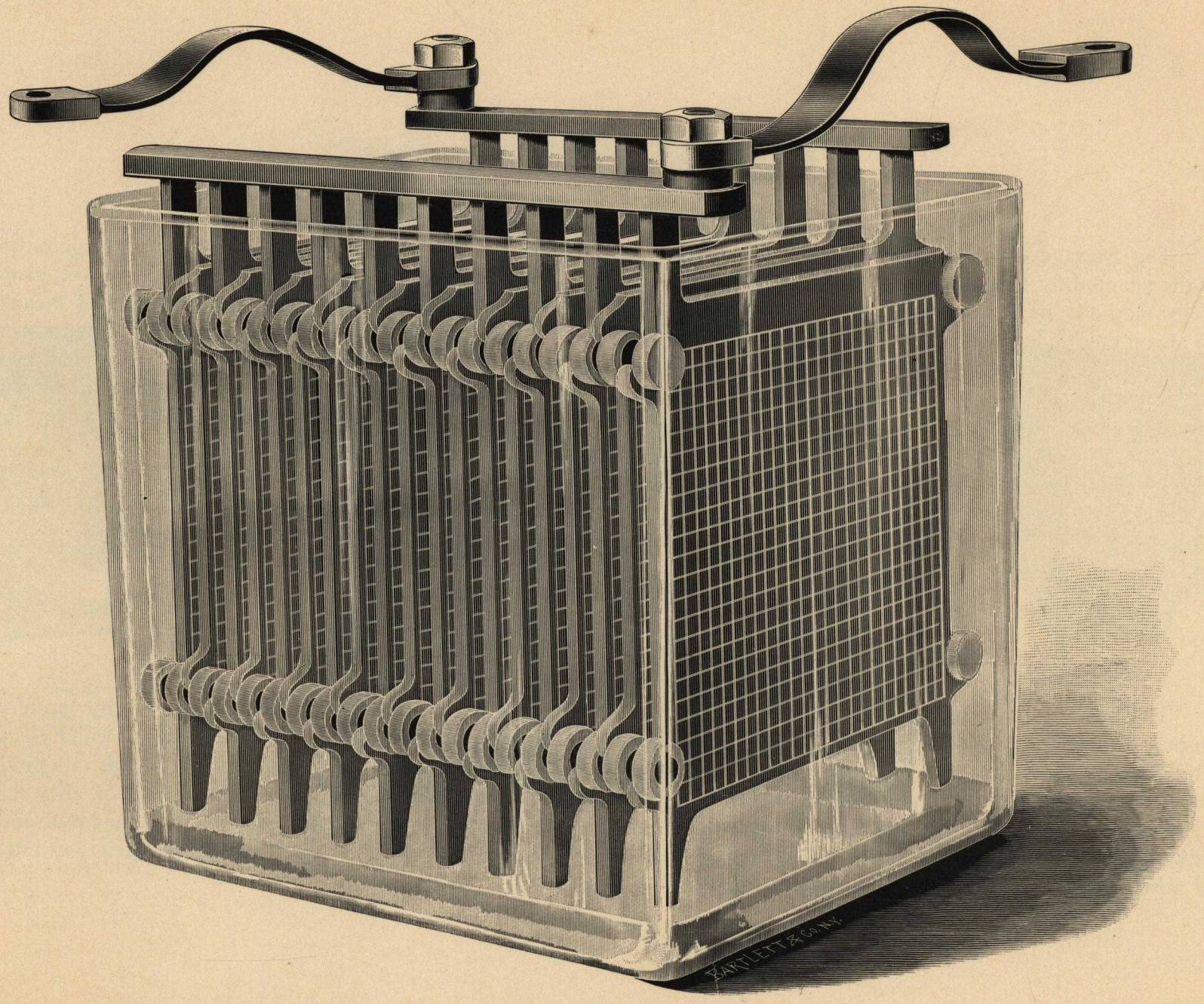
FIG. 13.

CAR LIGHTING BY STORAGE BATTERY.

The Storage Battery offered by this Company, by reason of its compact form, small weight, and large output, is specially adapted for this purpose, and affords at once the simplest, most direct, and most economical method yet proposed. Various methods have been proposed for accomplishing this end, such as running a generator on the train by means of a small steam engine located either on the locomotive or in a car, or by the movement of the car itself, the generator being connected to the car axle, or the generator is made to charge a set of storage batteries; but none of these proposed methods have the merit of simplicity (all being more or less faulty and complicated), which the simple system of application of Storage Batteries as proposed by this Company has. The Batteries are either charged at the ends of the route or at certain way stations and are carried in a box under the car body. The car is supplied with lamps and certain necessary switches and safety and regulating devices, the whole being under perfect control, not likely to get out of order, durable and economical. A similar system has also been devised for the lighting of street cars which are not propelled by electricity, and, in fact, to all moving and transporting vehicles.

GENERAL USES OF THE STORAGE BATTERY.

The Storage Battery is also applicable to a great variety of other purposes; such as medical batteries for cautery and other purposes, telegraphy, running small motors, portable lights, etc., etc., and in fact to about all purposes to which electricity can be applied. They may be charged with electric energy slowly or at a high rate, and discharged at a high rate or slowly, as is desired; any source of power may be used to run the charging dynamo, either steady or intermittent, or they may be charged by means of a primary battery, and they will yield the stored energy at a perfectly steady and constant rate, and they are always ready for use. This facility of use renders the Storage Battery of very great value for a great variety of purposes, all of which it is the province of this Company to exploit.



STORAGE BATTERY.

FIG. 14.

THE ARC SYSTEM.

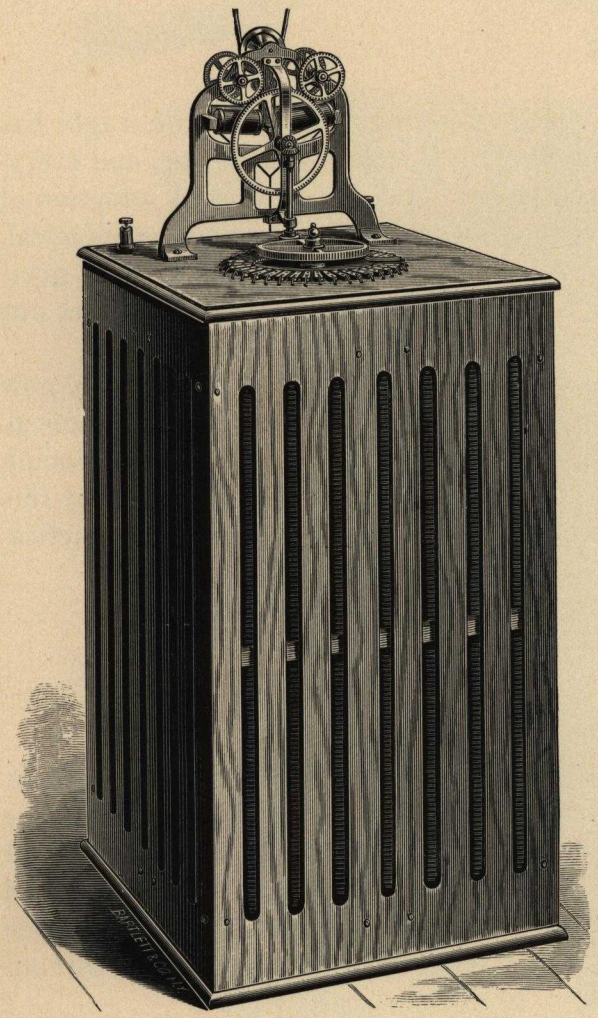
There is now no longer any question as to the practical success of Electric Lighting. The Electric Light has displaced and is displacing Gas Light every day, and the demand for this form of lighting is steadily increasing, and everything points to its permanent commercial success. The experimental stage has been passed, and the continued adoption of the Electric Light, both Arc and Incandescent, is assured. This being the case, the essential thing is a safe, economical, practical system of lighting—one which is sure and steady in its action, costing the minimum amount compatible with good work, and one which is simple in its construction and general arrangement, having no complicated apparatus liable to get out of order at any moment, and needing no expert attendance to keep it in order.

After much time and expense, this Company have perfected their Arc Electric Lighting apparatus, which they now offer to the public in the belief that it is all that it is claimed to be, and all that is required—safe, economical, and practical. Mr. E. R. Knowles, their present electrician, has perfected and rendered practical the system which they are now introducing into use. The principles involved in the Knowles system are unique, and broadly covered by patents now held by this Company and others which are now pending in the Patent Office, and the system is of the utmost simplicity and practicability.

THE DYNAMO.

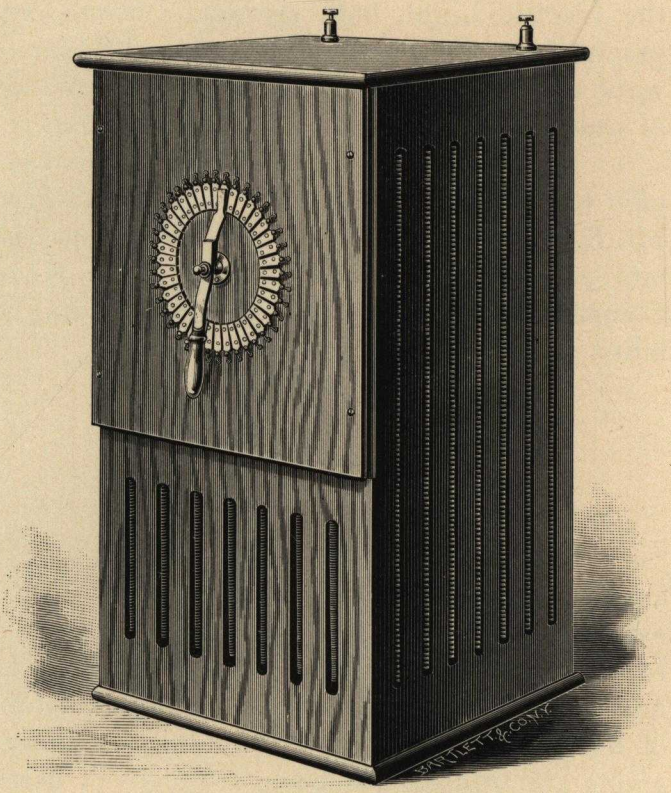
The dynamo used for Arc Lighting is of the Gramme type, and is represented in Figs. 1 & 2. Its distinguishing feature, among others, is its sectional armature, shown in Fig. 3, which admits of the building of a Gramme ring with very little expense, with perfect uniformity of winding, and one from which any coil can be removed and replaced at any time without rewinding or disturbing the whole armature. The machine is compact, thoroughly well built, and embraces many points of novelty and practical utility, all of which tend to make it durable, safe, and certain, as well as economical in its action. Some of these machines have been running constantly for over one year, 18 hours a day, under very trying circumstances, without giving any trouble or showing any signs of deterioration.

These machines are all made to exact sizes, and all parts are interchangeable, so that in case of accident any part can be obtained and substituted for the injured part with the least possible delay and expense. They are made at present in three sizes of 5, 10, and 25 light capacity, and a 40 light size will be added in the near future.



AUTOMATIC RHEOSTAT AND REGULATOR.

FIG. 15.



RHEOSTAT.

FIG. 16.

THE ARC LAMPS.

The arc lamps, single and double, are represented in Figs. 5 & 6. They are of the simplest construction, containing no parts to get out of order, and are steady and positive in their action.

No other lamp in use at the present time, in this country, works upon the principle on which these lamps operate. Most if not all lamps in use at present work upon what is known as the differential principle, depending on the difference in pull exerted by two magnets, one against the other, for their feeding action.

The lamps made by this Company work on what is known as the derived circuit principle, there being no differential action whatever; the feed being absolutely positive and the length of the arc as nearly constant as it is possible for it to be kept, never varying more than one hundredth of an inch from its normal length, although the length of the arc in the lamp can be varied, at will, from one thirty-second to three sixteenths of an inch.

All of the action of this lamp is accomplished by the direct action of magnetism and gravity, without any springs, dashpots, or similar retarding devices.

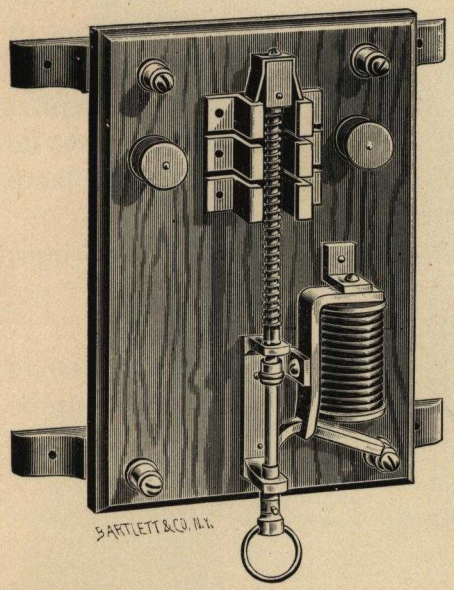
This is the first and only successful lamp working on this principle in practical use at this time.

The lamp is of pleasing appearance, and is thoroughly insulated by incombustible insulation, so that it is impossible for it to be burned out, owing to carelessness on the part of the trimmer. The globes are held in such a way that they can be lowered when it is necessary to trim the lamps or to get at the lower part of the lamp, thus doing away with any necessity for taking the globe off the lamp, and lessening the liability to breakage.

The double lamp is of great simplicity, each set of carbons being independent of the other, and one can be handled and trimmed while the other is in action.

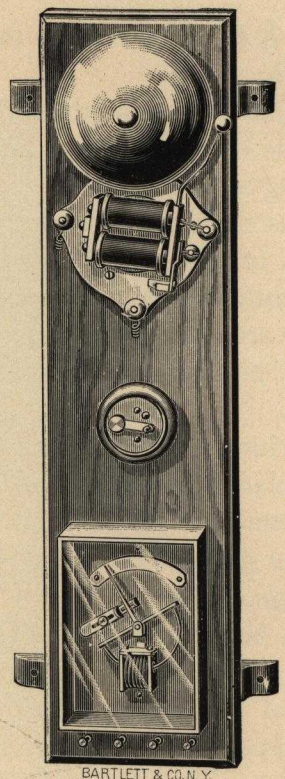
This lamp shifts automatically and positively from one set of carbons to the other at the proper time, striking its full arc instantly, and so quickly is the change made that it is barely perceptible. The current can also be shifted from one set of carbons to the other, back and forth at will, while in action, thus enabling the lamp to be kept constantly running, without stoppage, for any length of time—a result not obtainable with any other double lamp now in use.

These lamps are offered in the belief that they are unsurpassed in durability, safety, simplicity, and steadiness of action.



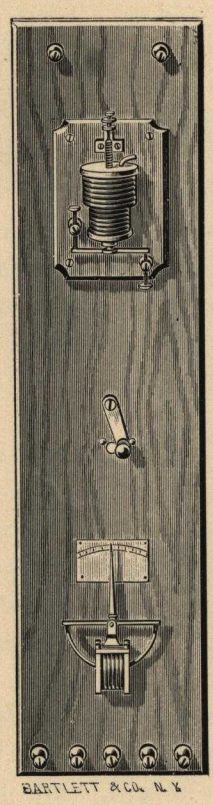
SAFETY CUT-OUT (BATTERY).

FIG. 17.



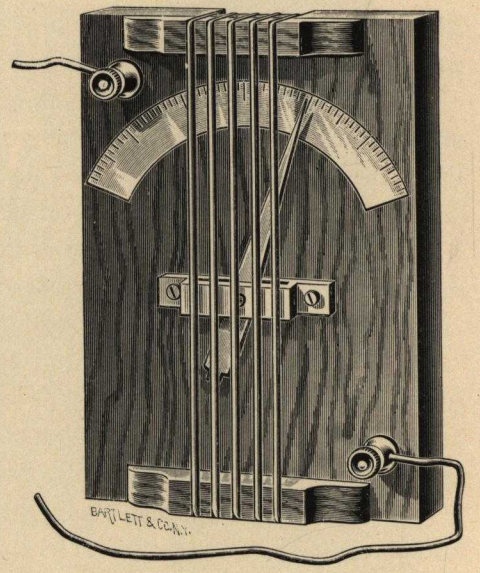
CURRENT INDICATOR AND ALARM.

FIG. 18.



WALL REGULATOR (DYNAMO).

FIG. 19.



CURRENT INDICATOR.

FIG. 20.

THE REGULATOR.

The automatic Regulator is a simple and novel device, by means of which the current supplied to the lamps is kept perfectly even and uniform, whether there be one or the full complement of lamps in circuit, varying automatically the action of the dynamo with every fluctuation of the circuit, keeping the current constant, and varying the power exactly in proportion to the work done. There are two forms of Regulators made—one acting at the dynamo to keep the current in the circuit constant under all changes of resistance, and the other acting independent of the dynamo and operating at any point of the circuit to keep a constant circuit resistance under all variations of current. (Figs. 7 & 15.)

THE INDICATOR.

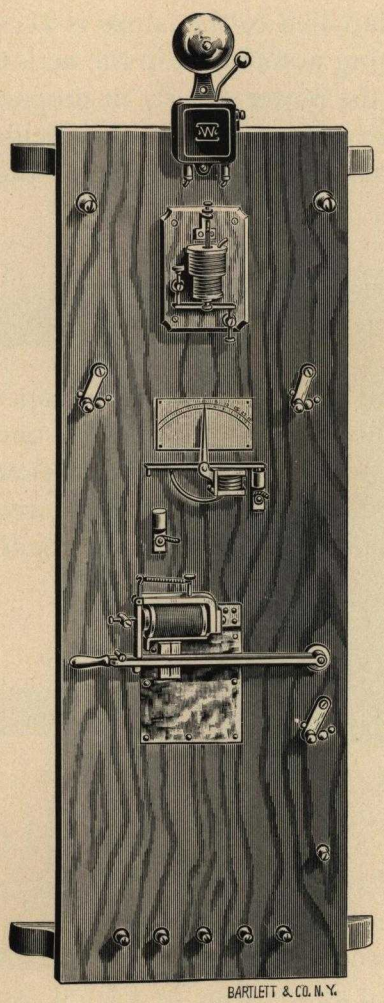
With each dynamo there is supplied a simple and novel indicator, shown in Figs. 13, 18 & 20, whereby the proper strength of current to be supplied to the lamp circuit can be ascertained and regulated, and which shows every variation and fluctuation of the same. This indicator is arranged both with and without a bell attachment, which, when the current falls below or rises above a fixed amount, rings a bell, and calls the attendant's attention to the fact. This indicator is also manufactured as an am-meter and volt meter, for general electrical measurements, and it is offered as a simple and reliable instrument, well adapted for the uses for which it is designed.

THE CIRCUIT CUT-OUT.

A circuit cut-out, for use at the entrance of circuits to buildings or for loop circuits, is also supplied. It is of simple and compact construction, and certain and positive in its action. (Fig. 17.)

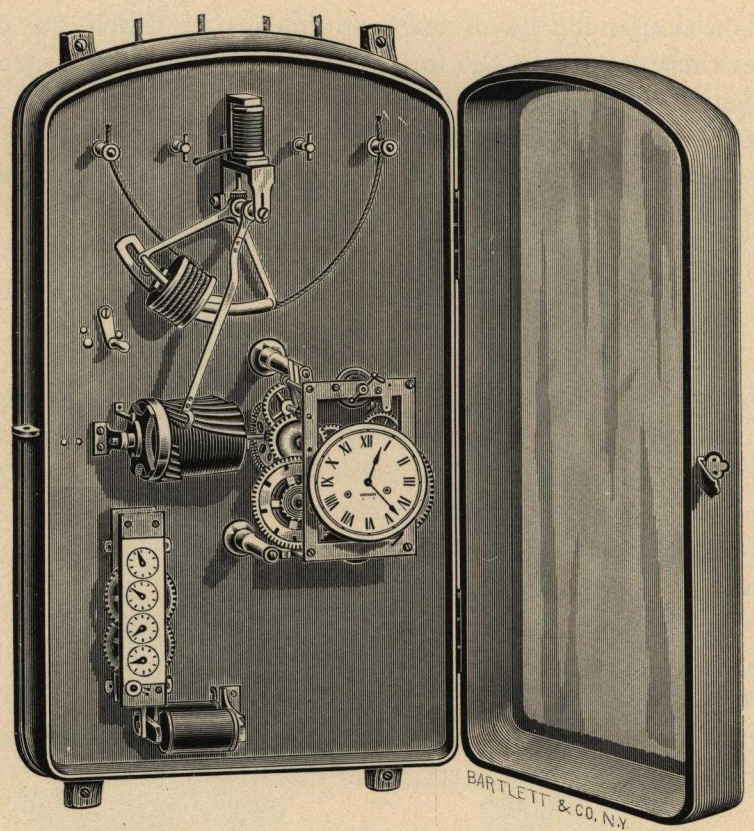
POLE TOP AND HOOD.

The pole top and hood used with this system are represented in Fig. 10. They are so arranged that the main circuit can be kept closed at all times, whether a lamp is in circuit or not, and any lamp can be removed at any time or a lamp can be placed in circuit without breaking the main circuit or in any way interfering with the other lamps while they are in operation. The lamp is perfectly insulated from the frame in a very simple manner, so that a ground on the frame is impossible, and all danger of shock is obviated. The pole top and hood are light and graceful in appearance, and are believed to fill every requirement which such apparatus is supposed to need.



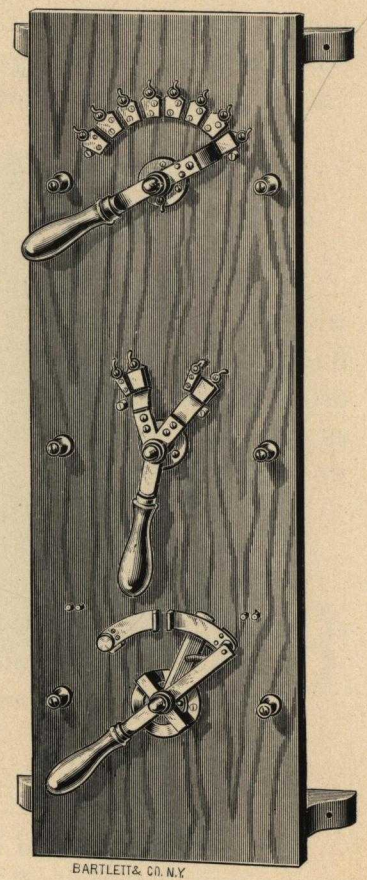
WALL REGULATOR AND SAFETY CUT-OUT (DYNAMO).

FIG. 21.



METER.

FIG. 22.



BATTERY CHARGING BOARD.

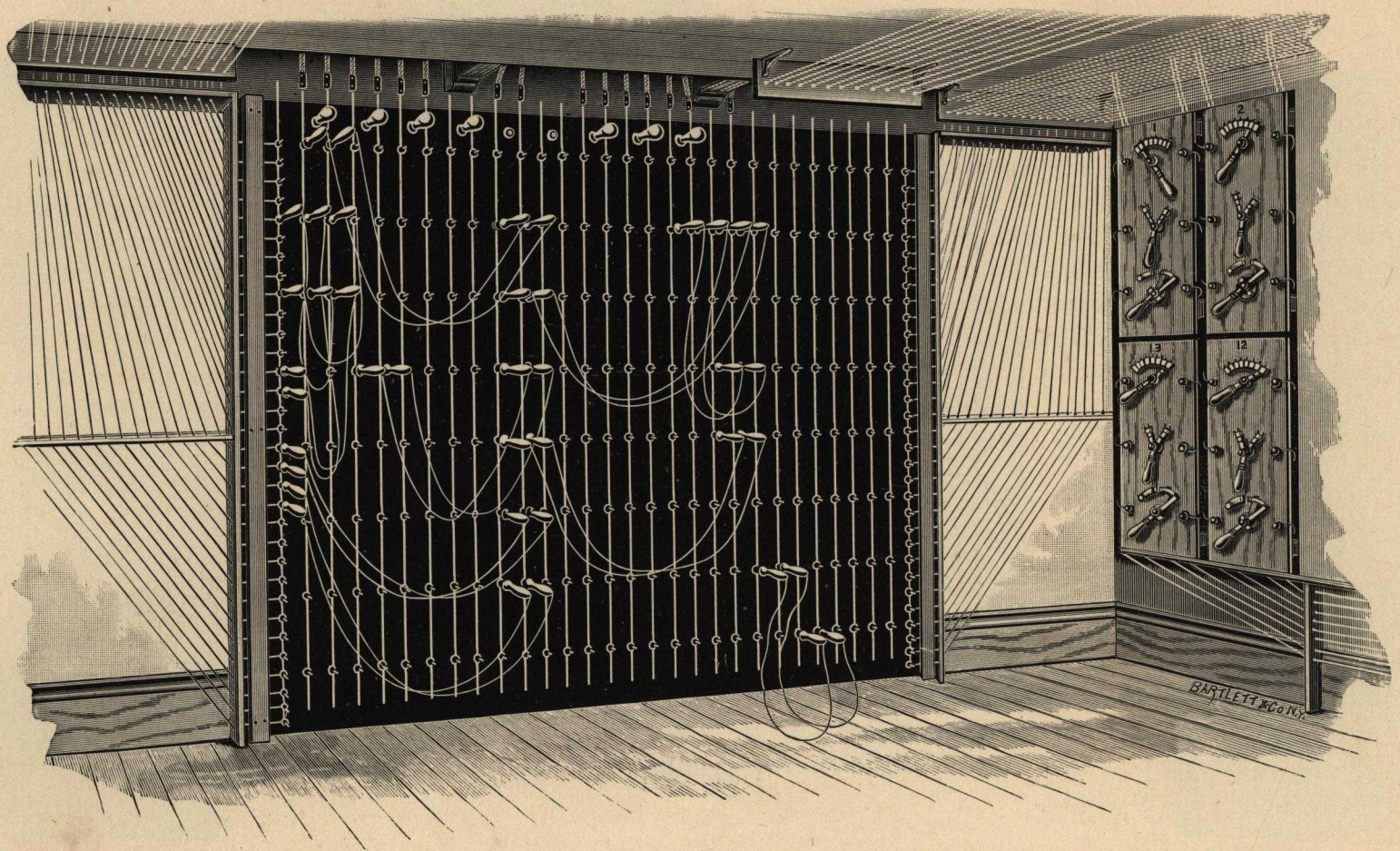
FIG. 23.

CROSS STREET SUSPENSION.

By this method of suspension the lamp is hung diagonally across the intersection of the streets so that the light can illuminate in all directions through the streets forming the intersection. The lamp, suspended by a sleet-proof pulley, runs on a strong guide wire, and is so arranged that if the guide wire should break the lamp will be caught and held by the auxiliary cable used to pull the lamp in and out, to and from one of the supporting posts, for the purpose of trimming and cleaning it. The guide wire is fastened to a turn buckle at one end, by means of which the slack can be taken up from time to time. The whole apparatus is neat and simple in arrangement, durable and safe, and economical as to cost, and is the only successful method of suspension by means of which the full value of the lighting powers of the lamp can be obtained.

THE ELECTRIC METER.

This meter, shown in Fig. 22, is designed to overcome the inherent defects of most of the other electric meters, and yet give an accurate record of the amount of current flowing in a circuit for any given length of time. It is simple in construction, combining a varying electric device with a constant time device; of large range; recording as accurately with a low current strength as with a very high current strength and not liable to get out of order under ordinary usage. It is also of low cost, there being no complicated mechanism in it. The meter is inserted in the main discharge circuit and is arranged to record in lamp hours or when desired directly in dollars and cents, so that a simple inspection will at once show the exact cost of the current used.



STATION SWITCH-BOARD (BATTERY).

FIG. 24.

THE COMBINATION SYSTEM.

Recognizing the necessity for a compact, economical, interchangeable system of lighting, which shall combine all the features of the Battery, Incandescence, and Arc methods of lighting, Mr. E. R. Knowles has devised a system, bearing the above title, which unites within itself all the good qualities of the above enumerated methods of lighting, and yet is very simple, compact, and efficient. In general terms, the system consists of a central generating station, furnished with all necessary appliances for delivering a constant current of electricity. Connected with this station by a *single conductor* is a set of Arc lights distributed in the usual manner, and sets of storage cells furnished with all necessary appliances for charge and discharge and located at such points as may be desired. Each set of storage cells is the center of distribution for a system of incandescence lighting. Each lamp and set of batteries is furnished with an automatic polarized cut-out, those on the arc lamps operating when the current is in one direction and those on the sets of batteries operating when the current is reversed or in the opposite direction. All that is needed to do to run one set of devices and exclude the other is to set the current in the proper direction at the generator, which is provided with a reversing switch for this purpose. By this arrangement both sets of devices cannot be run at the same time, but either set may be thrown into or out of service as may be desired, and only one conductor is needed. The same generator of electricity is used for both sets of translating devices, all being arranged to work with the same current strength. During the day, such a station is at work charging the storage system, which when fully charged are cut off and each then becomes a separate incandescence plant. During the night the station is at work running the system of arc lighting. By these means a central generating station may be made to do double work, combining in itself capacity for both arc and incandescence lighting, and earning an income both night and day, instead of, as at present, only during a portion of the twenty-four hours. This system is also applicable to all existing arc lighting systems, and is a means by which their capacity and income can be nearly doubled at a very small comparative outlay of money. Attention is called to the extreme flexibility of this system, admitting as it does of incandescence lights being distributed over as large areas as the arc lights are, with very small increase in expenditure for conductors, none being needed from the generating station to the batteries except the regular arc light wire, and all of the wires needed for distribution from the battery stations being quite small in comparison with those of any other system of incandescence distribution. By this system incandescence lights can be placed at any point at any distance from the generating station, a thing which cannot be done by any other system of lighting.

GENERAL REMARKS.

All cities and towns in the United States of any size will, sooner or later, be illuminated by Electric Lights. It is only a question of time. This being the case, it is important that those intending to introduce this method of illuminating be posted, both as to the character of the light and the commercial value of the various systems which are offered for sale. There are a large number of systems of Electric Lighting, good, bad, and indifferent, which are being operated with more or less success, and it is of the first importance that intending purchasers should examine them thoroughly, and become familiar with their workings before deciding which system they will adopt. There are several points with regard to Electric Lights in general which it is well to remember. There are two general types of arc lamps: those working with a clutch and those working with gear; and the result of experience points to the fact that the best running lamps are those which work with gear. They require less care, are less liable to get out of order, and are much more uniform in their action. Again, there are offered in the market lamps of different degrees of candle power. Some are 1,200 candle power and some are 2,000 candle power, nominal. None of these lamps run at any such power. The average 2,000 candle power lamp gives about 600 to 700 candle power, and the half-lamps, or 1,200 candle power lamps, give about 300 candle power. We do not want less light, but more light, and the half-lamps are not satisfactory. Again, great stress is laid in some systems on the economy of power, some claiming to give a lamp for each half horse power expended. The fact remains, however, that to give what is called a 2,000 candle power lamp, at least nine-tenths of a horse power is required; and where the claim is made to furnish a lamp for one-half horse power it must be understood that it is for what is called a half-lamp, of nominal 1,200 candle power, or the parties are misrepresenting the matter. It is not possible, by any system of lighting, to give a 2,000 candle power light by the expenditure of one-half a horse power of energy. Again, great stress is laid by some companies on their system of automatic regulation, some claiming that theirs is the only way in which it can be done, and that they are the sole owners of the only method by which it can be accomplished. The truth of the matter is, that in not one case out of one hundred is automatic regulation necessary; and where it is necessary there are several good systems by which it can be accomplished, and which are not owned by any one company. In calling your attention to our system, all we ask is that, before you decide on a system of lighting for your city or town, you will investigate the various systems of lighting in use, and give our system as careful an investigation as you do the others. We feel sure that if you will do so our system will compare most favorably with any other in use. There is another point to which we wish to call your attention, and that is what you will have to pay for a Plant, should you intend installing one, and what it will cost you to maintain it. It is not only necessary to get a good system of lighting, but it is also necessary to get that system at as low a price as is consistent with good work. A popular way, at present, to obtain Electric Illumination, is for a town or city to grant a franchise to some company, allowing them the exclusive privilege of illuminating the city or town for a certain period of time, the city or town paying for the lights a certain fixed rental per light during this time, with or without the privilege of purchase for a stipulated sum at the end of the franchise time or sooner, as the case may be. This is one of the most costly ways for the city or town to obtain Electric Illumination that could be devised.

In the first place, the city or town limits itself, without competition, to one system of lighting, be it good or bad. In the next place, the city or town pays to the company exploiting the lights a profit on each and all the lights, which profit the city or town might just as well save. Lastly, the city or town at the end of the stipulated time pays the Electric Light Company the stipulated price, which is usually high and quite unaffected by competition with other companies, or if they do not purchase they are out a considerable sum of money which they could have saved. The only and safe way is for the city or town to own and run its own plant. The subject should first of all be fully canvassed, then complete specifications of just what is needed should be made out and sent to all reputable Electric Light Companies, asking for bids on the same. After the contract is awarded, the company obtaining the same should be held to the specifications in every particular. In this way the city or town will get a good system of lighting for the lowest market price, will have control of it themselves, and will be able to run it in the most economical manner, and save all profits paid by rental of lights. The system, as described in this circular, is unique in many particulars. It has a gear lamp, is the only positive feed lamp in use, and is simple and durable. The dynamo is also simple and powerful, and the system is automatically regulated, if necessary. We claim our system to be as good as any system in use, and we are open to a fair competition at any time, with any other companies. Our desire is to introduce our system the same as any other commodity, by competition and at a fair manufacturers' profit. All we ask is that before purchasing elsewhere an opportunity be given us to show what we have and to give a price on the same.

THE AUTOMATIC FIRE ALARM SYSTEM.

This system has been devised for the purpose of protecting houses, stores, and all manner of real estate from damage by fire, by providing a means whereby, if a fire breaks out in any part of a building, it will be automatically registered at a central office and from there an alarm sent to the fire engine stations. This system, comprising thermostats, drop signal boxes, alarms, and all necessary apparatus for a complete automatic fire alarm system, is very simple in construction, sure in operation, and so arranged as not to be prevented from operating, in case of accident to the line wire, or for any of the ordinary causes to which such a system will be likely to be exposed. In operation, if a sudden rise of temperature beyond a predetermined limit occurs in any part of the building fitted with this system, a thermostat of novel construction acts automatically on a signal indicator box, located in the building, which immediately sets an alarm ringing and drops an indicator showing in which part of the building the fire has occurred. At the same time a signal is automatically sent to the central office, there registering the building in which the fire has occurred and calling attention to the fact by an alarm. From this office the alarm is at once sent to the fire engine stations and the engines and fire apparatus are at once sent to the spot where the fire has occurred. The system will operate in all kinds of weather, and under all ordinary circumstances; even if the line wire is broken or grounded it will operate, and means are provided whereby the operator at the central office can test the whole line at any time during the day, so as to ascertain their exact working condition, and see whether any breaks have occurred and any repairs are needed.

The whole system is complete in every detail and is offered in the belief that it will fully satisfy all the requirements of such a system.

Persons desiring to organize sub-companies to operate this system will be given terms, on application.

MISCELLANEOUS.

This Company is engaged in the manufacture of a number of auxiliary devices, all of which are of use in electrical work of every description, such as Am-meters, Volt meters, Automatic Circuit Cut-outs, Switches, etc., etc. The Am-meters, and Volt meters are of novel construction, direct reading, dead beat, and contain *no* permanent magnets, thereby needing no recalibration, but always reading correctly. One form of circuit cut-out is for cutting out and in lamps which are looped from a main circuit inside a building. It is so arranged that the lights can be run for any set length of time and then automatically cut out at the expiration of that time. It is also used for automatically charging and discharging storage batteries. Another form of automatic cut-out is for use where it is desired to run motors or other apparatus, other than electric lamps.

As matters now stand, when it is desired to run electric motors on an arc light circuit, unless it is a day circuit, of which there are comparatively few, it is necessary to send out an assistant and switch out all the lamps on the circuit, so that they shall not burn unnecessarily, and when needed they must all be switched in again. By means of this cut-out, arranged and operated on a system invented by Mr. Knowles, any number of motors or other devices can be operated on the same circuit wire with the electric lamps, all being under control at the central station and only one set of devices operating at a time; that is to say, when the motors or other devices are operating, the lamps are automatically cut out, and when the lamps are operating, the motors are automatically cut out, it being impossible to run both at the same time. No extra help is needed, the whole being operated on one wire and under perfect control at the central station. A number of other devices are made, all of which are simple and efficient for the purposes for which they are designed. There is a large field for efficient apparatus of low cost price, and this field this Company will endeavor to occupy, in part at least, most of the apparatus in use being of so costly a character as to preclude its general use. This is especially so of testing instruments, and those offered by this Company are designed to give an efficient instrument at a price within the reach of all. This Company will sell any piece of apparatus manufactured by it, from a dynamo down to a switch, without any restrictions as to its use.

We desire to inform the trade that we have lately increased our facilities to manufacture all kinds of electrical apparatus, and that we shall be pleased to give individuals or corporations estimates to make for them any kind of electrical devices they may desire manufactured.

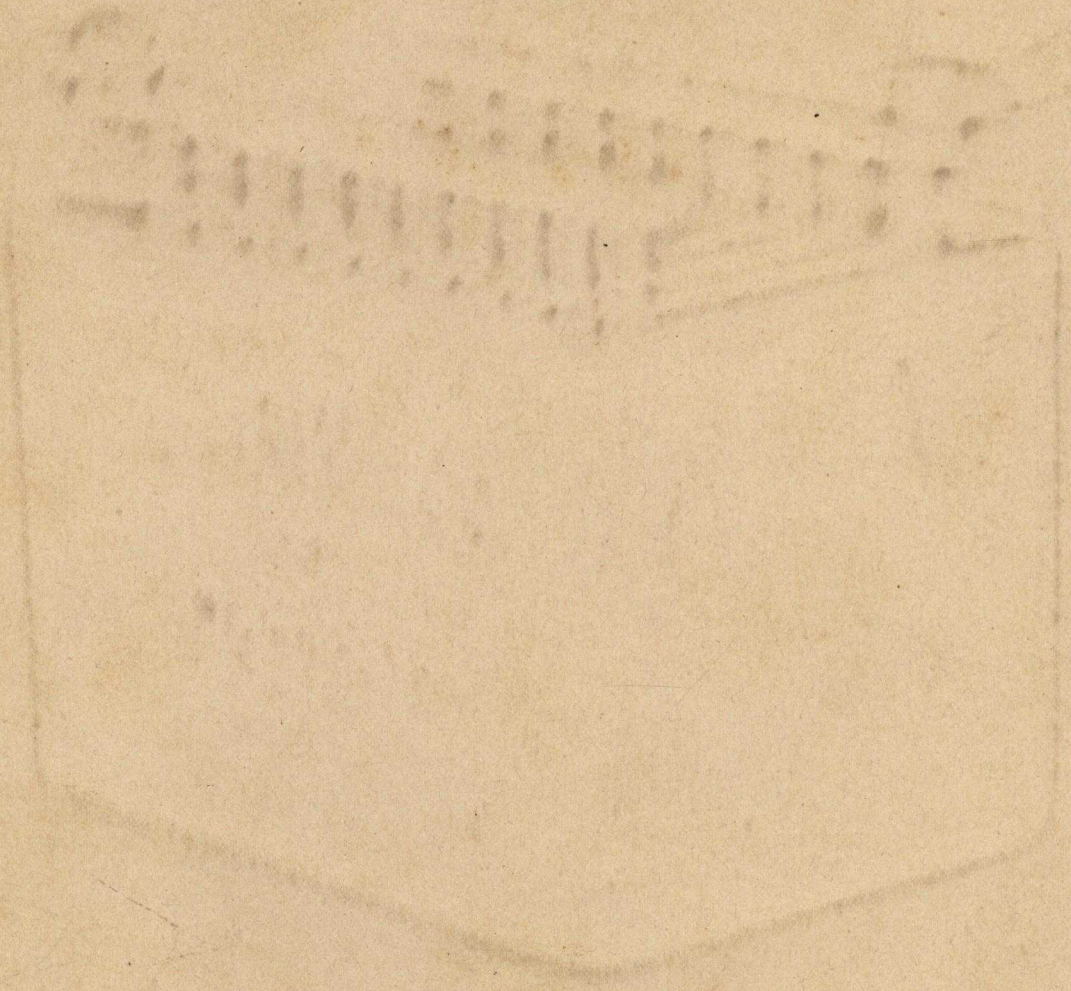
This Company is also the owner of Arc Lamp Patents issued to R. R. Moffatt and also on electric meters invented by T. Woolcott.

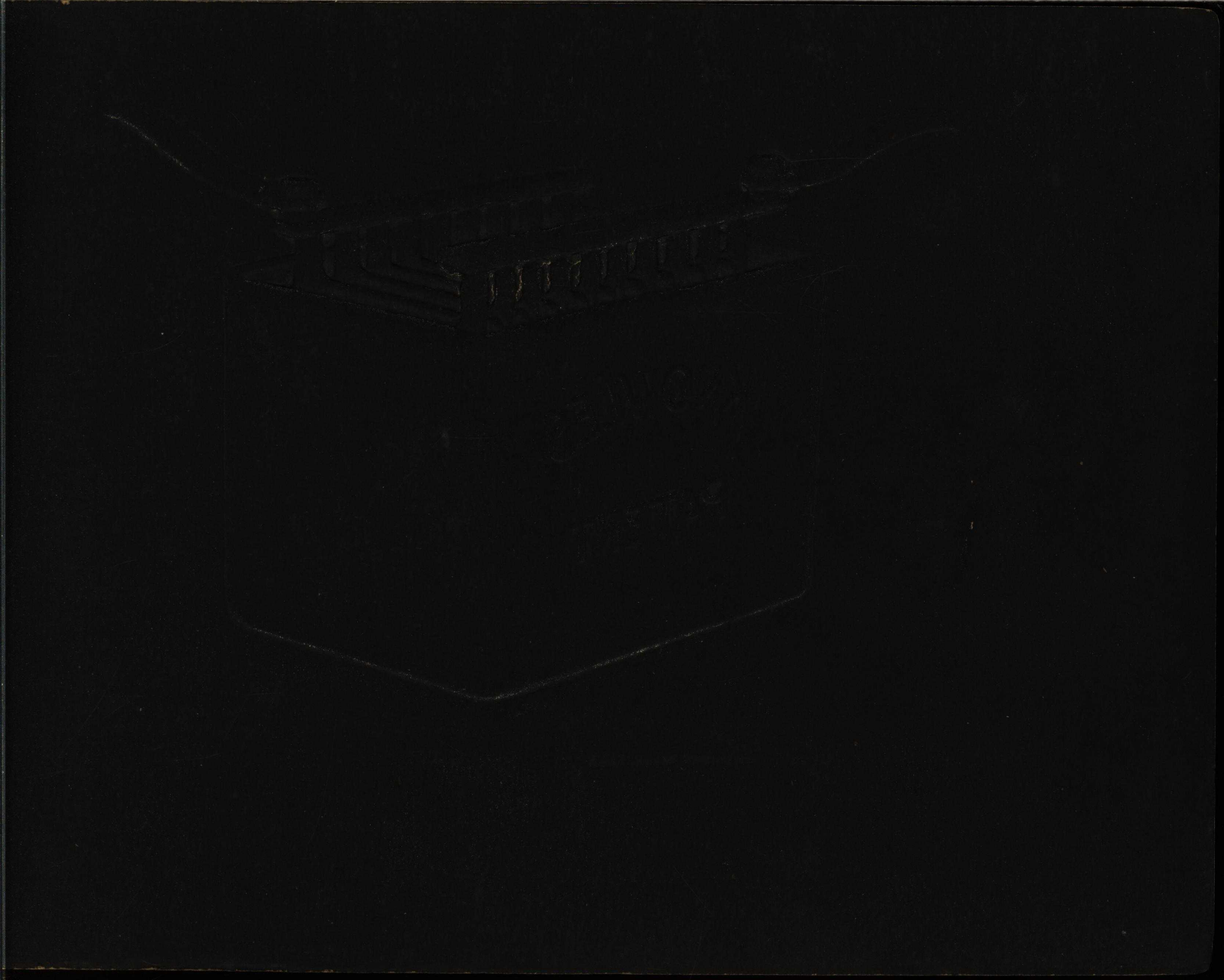
TO THE PUBLIC.

Correspondence is solicited from parties investigating the subject of Electric Lighting for cities, towns, parks, factories, or private property; and the Company will, at any time, furnish upon application estimates of the cost of erection and maintenance of all kinds of plants requiring any number of lights, with or without power.

The Company makes a specialty of furnishing specifications and estimates to cities or towns contemplating Electric Lighting by means of the tower or pole system, using either steam or water power; also terms upon which sub-companies can be organized in any part of the United States.

Blanks, cuts of apparatus, and circulars, together with all information relating to the same, will be furnished upon application.





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